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**Central and Arctic region**

**Proceedings of the regional pre-COSEWIC assessment for Shortjaw Cisco  
(*Coregonus zenithicus*) in Canada**

**30-31 October 2012  
Burlington, ON**

**Co-chairs: Chantelle Sawatzky and Jim Reist**

**Editor: Claire Mastrangelo**

Fisheries and Oceans Canada  
Freshwater Institute  
501 University Crescent  
Winnipeg MB R3T 2N6 Canada

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## Foreword

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings may include research recommendations, uncertainties, and the rationale for decisions made during the meeting. Proceedings may also document when data, analyses or interpretations were reviewed and rejected on scientific grounds, including the reason(s) for rejection. As such, interpretations and opinions presented in this report individually may be factually incorrect or misleading, but are included to record as faithfully as possible what was considered at the meeting. No statements are to be taken as reflecting the conclusions of the meeting unless they are clearly identified as such. Moreover, further review may result in a change of conclusions where additional information was identified as relevant to the topics being considered, but not available in the timeframe of the meeting. In the rare case when there are formal dissenting views, these are also archived as Annexes to the Proceedings.

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<http://www.dfo-mpo.gc.ca/csas-sccs/>  
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## SUMMARY

A regional science peer-review meeting was held from 30-31 October 2012 in Burlington, Ontario. The objective of this meeting was to peer review existing information held by Fisheries and Oceans Canada (DFO) relevant to the COSEWIC status assessment for Shortjaw Cisco (*Coregonus zenithicus*) in Canadian waters, particularly with reference to data related to the status and trends of, and threats to, this species inside and outside of Canadian waters, and the strengths and limitations of the information. This information will be available to COSEWIC, the authors of the species' status report, and the co-chairs of the applicable COSEWIC Species Specialist Subcommittee. Meeting participants included experts from DFO, Université Laval, Great Lakes Fishery Commission, and the Ontario Ministry of Natural Resources.

This Proceedings report summarizes the relevant discussions from the meeting and presents revisions to be made to the working papers. It is available on the [Canadian Science Advisory Secretariat \(CSAS\) website](#). The working papers reviewed at the meeting and the advice from the meeting will be published as Research Documents and an Advisory Report on the CSAS website once finalized.

### Compte rendu de l'évaluation pré-COSEPAC à l'échelle régionale du cisco à mâchoires égales (*Coregonus zenithicus*) au Canada

## SOMMAIRE

Une réunion régionale d'examen scientifique par les pairs a eu lieu les 30 et 31 octobre 2012 à Burlington, en Ontario. Cette réunion avait pour objet de faire examiner par les pairs l'information du MPO pertinente pour l'évaluation de la situation par le COSEPAC du cisco à mâchoires égales (*Coregonus zenithicus*) dans les eaux canadiennes, y compris les données sur la situation de l'espèce, les tendances observées et les menaces qui pèsent sur elle, tant dans les eaux canadiennes que dans les eaux étrangères, ainsi que les points forts et les limites de cette information. L'information sera ensuite mise à la disposition du COSEPAC, des auteurs du rapport sur la situation de l'espèce et des coprésidents du sous-comité pertinent de spécialistes des espèces du COSEPAC. On comptait parmi les participants des experts du MPO, de l'Université Laval, de la Commission des pêcheries des Grands Lacs et du ministère des Richesses naturelles de l'Ontario.

Le présent compte rendu résume les discussions pertinentes de la réunion et présente les modifications qui doivent être apportées aux documents de travail. Ce document est publié sur le site Web du [Secrétariat canadien de consultation scientifique \(SCCS\)](#). Une fois terminés, le document de travail examiné à la réunion et les conseils qui en découlent seront publiés sous forme de documents de recherche et d'Avis scientifique sur le site Web du SCCS.

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## INTRODUCTION

In April 1987, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designated Shortjaw Cisco (*Coregonus zenithicus*) as Threatened (Houston 1987). The status was re-examined and confirmed in May 2003. The reason for the designation was that, "This species has been extirpated from lakes Huron and Erie and is in decline in Lake Superior and Great Slave Lake. It is still present in Lake Nipigon and numerous smaller lakes where its status is not well known. Threats include fishing, introduction of exotics and climate change" (COSEWIC 2003).

Shortjaw Cisco is presently listed on Schedule 2 of the *Species at Risk Act* (SARA) as Threatened (SARA Schedule 1 provisions do not apply).

A peer-review meeting was held at the Canadian Centre for Inland Waters, Burlington, Ontario, on 30-31 October 2012 to discuss the status assessment of Shortjaw Cisco. The purpose of the meeting, as described in the Terms of Reference (Appendix 1), was to peer-review existing information held by Fisheries and Oceans Canada (DFO) relevant to the COSEWIC status assessment for Shortjaw Cisco in Canadian waters, considering data related to the status and trends of, and threats to, this species inside and outside of Canadian waters, and the strengths and limitations of the information. The current state of knowledge about life history characteristics, population status, habitat requirements, distribution and threats to Shortjaw Cisco and its habitat were discussed at the meeting. Participants included DFO, Université Laval, Great Lakes Fishery Commission, and the Ontario Ministry of Natural Resources (Appendix 2). The meeting followed the agenda outlined in Appendix 3.

This information will be available to COSEWIC, the authors of the species status report, and the co-chairs of the COSEWIC Freshwater Fishes Specialist Subcommittee.

This Proceedings report summarizes the relevant discussions from the peer-review meeting and presents revisions to be made to the associated research documents.

## DISCUSSION

The meeting co-chair provided the participants with an introduction to the CSAS Science peer review and advisory process, as well as the COSEWIC assessment process. She explained that the aim of meeting was to organize DFO data and information and formally review it for the COSEWIC assessment report writer. A second key aspect of the meeting was to look at the taxonomic validity of Shortjaw Cisco outside of the Laurentian Great Lakes and Lake Nipigon and to update existing information with respect to new understandings of designatable units (DUs) within the Great Lakes and Northwest Territories.

Six working papers had been developed by participants and provided in advance of the meeting. The working papers were the basis for discussion and participants were encouraged to add to or recommend revisions to the material as needed to ensure that the best, most accurate information was included.

The co-chair suggested participants consider the following questions as they listened to each presentation:

What are the taxonomic identities and corresponding identities of Shortjaw Cisco-like forms?

What is the number of DUs?

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What is the relevance of each couplet in the DU key used by COSEWIC? How does one choose which couplet to use in his/her research?

### **COSEWIC Designatable Units**

Presenter: Nick Mandrak

The presentation on DUs covered the reason for their existence, the approach to the status assessment of DUs, guidelines for their identification, an overview of the COSEWIC Freshwater Fishes Subcommittee DU key, and DUs as they apply to Shortjaw Cisco.

The presenter noted that, in a previous discussion, it had been asked whether variation in spawning time may be a distinctive or rare trait. A participant responded that there are likely multiple populations with variation in spawning time even within Shortjaw Cisco. Another noted that there is also variation in stable isotope analysis between historic and current flocks<sup>1</sup>. The presenter suggested that variation in isotopic signatures may support theories of distinctive or local adaptations. It was confirmed that it would be possible to conduct such research.

A participant also asked how the group was using the terms "systematics" and "taxonomy". Participants agreed that there were no clear definitions of the terms, and that COSEWIC should be notified that this issue has the potential to create a lack of clarity in the research process.

It was noted specifically that there are a lack of taxonomic updates in the context of systematic phylogeny, and that this needs to be highlighted as a knowledge gap.

The participants discussed future research goals and opportunities. One of the co-chairs proposed that the group discuss outstanding research questions, the pursuit of which would support any given scientific opinion. The co-chair requested that the participants write up these questions, framed by topic and area (e.g., whether they are lake-specific, within a given biogeographic zone, and the nature of the question), and provide them to the other co-chair to include them as next steps in the research document.

### **Shortjaw Cisco in inland Ontario lakes**

Presenter: Scott Reid

The presentation gave recent data on Shortjaw Cisco in inland lakes. It covered distribution of Shortjaw Cisco in Ontario, recent sampling of inland lakes, and the DU hierarchy of evidence for each water body. The presenter noted that the information provided was opportunistic and not a comprehensive study of the distribution of Shortjaw Cisco.

A participant asked if there was a predictive model of Shortjaw Cisco distribution. It was confirmed that no such model existed. The question was then raised as to whether a predictive model should be developed and tested through monitoring. Broad-scale monitoring sometimes covers ciscoes but may under-represent them as it does not include pelagic sampling and may not use the appropriate mesh size. It was agreed that predictive modelling and testing of the model would make an excellent research objective and be a good investment of resources.

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<sup>1</sup> A species flock is a diverse group of related species endemic to a particular area. It may arise when a species diversifies to occupy a variety of ecological niches or when a species acquires an adaptation that allows it to exploit a new ecological niche.

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## Morphological Diversity

Working Paper: Patterns of morphological diversity in ciscoes distributed within three of Manitoba's glacial relict lakes, with reference to Shortjaw Cisco (*Coregonus zenithicus*)

Authors: D.A. Boguski, L. Murray, T.C. Pratt, J.D. Johnson, and J.D. Reist

Presenter: Dave Boguski

### Abstract

Shortjaw Cisco, *Coregonus zenithicus*, shows exceptional levels of phenotypic diversity occurring in numerous postglacial lakes in North America. Here, we contrast the morphological diversity of the species from its type locality in Lake Superior to three continental lakes (Reindeer, Athapapuskow, and George lakes) in Manitoba using traditional morphological methods. In particular, we investigate if morphological variation exists among and within lakes given the potential for distinct morphologically adapted groups. Discriminant function analyses based on 26 morphological variables revealed that *C. zenithicus* from Lake Superior represents a distinct morph relative to putative conspecifics in Manitoba, and that morphological structure is strongly mediated by geography (i.e., location) and morphometry of the lake. Gill-raker counts, a highly heritable trait, showed nearly discrete distributions for up to three sympatric general cisco morphs within a lake; only a single morph from Reindeer Lake had similar gill-raker counts to *C. zenithicus* in Lake Superior despite obvious morphological differences (e.g., a smaller standard length). Consequently, morphotypes may be highly divergent in ecological habits, and thus have important management and conservation implications, but more broad-scale research is required. This study provides corroborating evidence to support the variability of *C. zenithicus* across its range, and highlights the necessity for re-evaluating the alpha taxonomy of *C. zenithicus* and closely-related Cisco (*C. artedii*) species.

### Discussion Points

The presenter noted that only fish larger than 140 mm were used in the analyses; however, smaller fish (e.g., dwarf forms) may have been sexually mature and not included in the study.

It was also noted that an *a priori* grouping of morphotypes was required for the statistical analysis.

There was some discussion around the use of gill-raker space (GRS) and arch length in the analyses. Ultimately it was concluded that arch length and GRS are confounded variables, and so one should be removed from the calculation. It was also suggested that the classification table from the presentation be included in the report.

A participant stated that their research had been referenced incorrectly in the paper. They also noted that faster mutating regions should be targeted for microsatellite marker comparison studies rather than CO-I analysis, which will not distinguish morphotypes.

The following revisions were recommended for the working paper:

- Re-run analyses using all variables (size was originally removed, but may have still been reflected in the results);
- Do not include GRS in analyses, as it is redundant;
- Show accuracy rates of individual group analyses;
- Confirm the location at which the type specimen was caught.

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## Lake Superior and Lake Nipigon ciscoes

Working paper: The Biology and Relative Abundance of Shortjaw Cisco (*Coregonus zenithicus*) in Lake Nipigon

Author and presenter: Tom Pratt

The presentation offered an assessment of Shortjaw Cisco in lakes Superior and Nipigon. The presenter discussed the Lake Superior using two papers he had published earlier in the year (Pratt 2012; Pratt and Chong 2012) and Lake Nipigon using the working paper prepared for the pre-COSEWIC meeting.

### Abstract

Shortjaw Cisco (*Coregonus zenithicus*) were originally described in Lake Nipigon in the 1920s, and have been consistently identified in the limited number of subsequent cisco surveys of the lake. With the exception of ecomorphological and genetic research conducted on the cisco community of Lake Nipigon in the late 1990s, little attention has been focused on any cisco species from this lake. DFO Science was charged with conducting a pre-COSEWIC assessment for Shortjaw Cisco, and this manuscript assesses 1) the current life history characteristics; 2) the characteristics or elements of the species' habitat; 3) threats to the species; and 4) population trends with a limited time series for Shortjaw Cisco from Lake Nipigon. The relative abundance of Shortjaw Cisco has declined more than 50% in Lake Nipigon from the 1998-99 through 2008-09 period, and no recent strong year-classes were observed. Mean age of the population is ~12 years, and annual mortality estimates are low (11.7%). The Lake Nipigon Shortjaw Cisco population is dominated by females (sex ratio is 65% female), which appear to have greater longevity than males. Shortjaw Cisco in Lake Nipigon prefer shallower depths (mean depth of capture 30.2 m) than their putative conspecifics from the Great Lakes. The Shortjaw Cisco population in Lake Nipigon is a *Mysis* spp. specialist, with the majority of individuals consuming only this prey species. Anthropogenic threats are limited on Lake Nipigon, as only a small fishery is prosecuted on the lake. Observed declines are more likely due to food web changes due to invasive species, or competition with other native fishes.

### Discussion Points

A participant asked if climate change influences Shortjaw Cisco habitat. The presenter responded that he was unsure; a knowledge gap exists for winter seasons. In regard to the question of whether *Mysis* and/or *Diporeia* densities correlated with Shortjaw Cisco population sizes, a participant responded that substrate mapping using hydro-acoustics may reveal further information on where the two species exist in the two lakes.

During a conversation about genetics and morphometrics, a participant noted that local complexity in itself demands increased taxonomic differentiation by COSEWIC. They added that conservation must occur both across lakes as well as within lakes and should not necessarily be based on systematics.

There was a discussion around the specialization and preservation of individual flocks. After some debate, it was proposed that establishing conservation efforts for each individual ecosystem would be a more effective approach to protecting the different species' groups. The participants agreed to wait until all the presentations had been given before deciding whether or not to recommend this approach.

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## Lake Huron ciscoes

Working paper: Evaluating the current status of deepwater ciscoes (*Coregonus* spp.) in the Canadian waters of Lake Huron, 2002-2012

Authors: N. Mandrak, T.C. Pratt, and S.M. Reid

Presenter: Nick Mandrak

### Abstract

Historically, all six species of deepwater ciscoes (*Coregonus* spp.) and Cisco (*C. artedii*) present in the Great Lakes were found in Lake Huron. In Lake Huron, the last record of Deepwater Cisco (*C. johanna*) was 1952 and Shortnose Cisco (*C. reighardi*) was 1985. Both species are now considered extinct. Of the species still present in other Great Lakes, the last record in Lake Huron of Blackfin Cisco (*C. nigripinnis*) was 1960, Shortjaw Cisco (*C. zenithicus*) was 1982, and the Kiyi (*C. kiyi*) was 1985. The purpose of this study was to evaluate the status of deepwater cisco species in the Canadian portion of Lake Huron.

Cisco samples were collected by the Chippewas of Nawash First Nation, in collaboration with Fisheries and Oceans Canada, Ontario Ministry of Natural Resources, and Parks Canada. Between 2002 and 2006, gillnets were set at 71 locations in depths of 30-200 m. Across all years, a total of 2552 ciscoes were collected in Lake Huron. Of these 2552 ciscoes, 1538 were Bloater (*C. hoyi*), 72 were Cisco (*C. artedii*), 20 were Shortjaw Cisco, and 320 could not be identified to species. The Shortjaw Cisco specimens were the first collected in Lake Huron since 1982.

### Discussion points

The participants had no revisions or additions to recommend for the research paper.

## Great Slave Lake ciscoes

Working Paper: Morphology and life history of the Great Slave Lake ciscoes (Salmoniformes: Coregonidae)

Authors: A.M. Muir, P. Vecsei, M. Power, C.C. Krueger, and J.D. Reist

Presenter: Andrew Muir

### Abstract

The ciscoes (Salmoniformes: Coregonidae) have radiated into complexes of closely related species, life history types, and ecological variants. The taxonomy of the North American ciscoes remains unresolved. We provide the first comprehensive description of the Great Slave Lake ciscoes by comparing gross body morphology, phenotypic and life history traits, and habitat use among morphs, and assessing the validity of morphs within the context of existing taxonomy. At a minimum, our analysis supports the hypothesis that the Great Slave Lake ciscoes include two strongly differentiated species (*Coregonus artedii* and *C. sardinella*) and an adfluvial *C. artedii* morph that is distinct from its lacustrine conspecific in terms of life history, morphology, age, growth, and mortality. *C. sardinella* has previously been identified from Great Slave Lake, but we provide the first comprehensive description of this species in the lake and confirm a significant range extension for the species. The lacustrine *C. artedii* differs little from descriptions throughout its range. In addition to these three ciscoes, linear phenotypic traits, gill-raker number and morphology, and growth data support the possible occurrence of two other, less-distinct morphs, the big-eye cisco *C. artedii* and *C. zenithicus*. Although the big-eye morph was not identified by cluster analysis of body shape and linear phenotypic measures, it was visually

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identified on the basis of differences in traditional phenotypic proportions, such as eye diameter, paired fin lengths, and head and gill-raker morphology expressed as thousands of standard length. In addition, the big-eye morph showed different age and growth structure compared to the other lacustrine cisco morphs. *C. zenithicus* was distinguished visually and by the statistical model of linear phenotypic traits as well as by gill-raker number and morphology, which were within the range for the species across its distribution. Identifying, characterizing, and managing locally-adapted cisco morphs that reflect important ecological and bioenergetic linkages is critical to conserving the ecological integrity of northern ecosystems.

### Discussion Points

The presenter asked for feedback on the paper, which had been submitted for publication and turned down. The reviewers' comments were included in the presentation: the two main concerns were that the study was site-specific and that the sampling of the sites did not have a fixed variable.

The participants agreed that some of the suggestions made by the reviewers were not feasible in the sampling of large lakes; however, they suggested that providing a more detailed description of Great Slave Lake and a more in-depth explanation of its value as a large, pristine water body in the introduction to the paper might help to make the case for closely examining this specific site.

A participant stated that a suggestion to compare ecomorphological variation within and between locations was viable, and that such a comparison could make for a strong argument if specific morphology was found to be repeated in different sites. They also suggested emphasizing the importance of ecology, in addition to morphology, to the study. Another participant suggested including a graph of morph numbers by depth and possibly breaking the paper into two papers: one descriptive and one hypothesis-driven.

### Great Bear Lake ciscoes

Working Paper: Variation in morphology, life history and ecology of cisco in Great Bear Lake, Northwest Territories, Canada

Authors: K. Howland, C. Gallagher, D. Boguski, J. Reist, L. Chavarie, and S. Wiley

Presenter: Kim Howland

### Abstract

Historical reports indicate that more than one form of cisco may occur in Great Bear Lake; these include *Coregonus artedii* and possibly *C. sardinella*. More recent depth-stratified sampling of cisco concurs with earlier studies and includes what may be two or more forms or species. Based on preliminary results, cisco captured in deeper waters of Great Bear Lake showed characteristics that are consistent with those described for Shortjaw Cisco (*C. zenithicus*) including shorter, fewer and more widely spaced gill-rakers, lighter paired fins and a diet consisting mainly of *Mysis relicta*. Other characteristics such as longer paired fins and greater body depth were not consistent with *C. zenithicus*, but are often associated with adaptation to vertically migrating in deeper water and have been noted in other deepwater coregonids such as *C. kiyi*. Deepwater cisco were found to differ in their life history traits, being smaller, later maturing and slower growing than their shallow water counterparts. In addition to variation by depth, we also observed consistent variation among geographically separated populations within deep and shallow water types, suggesting reproductive isolation and parallel evolution of these morphotypes within individual lake arms. With the exception of Great Bear Lake, *C. zenithicus* or a *C. zenithicus*-like form of cisco has been reported from most of the remnant

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proglacial Great Lakes in North America running from the Laurentian Great Lakes northwest to Great Slave Lake. Thus our findings may represent a northern range extension for this particular form or species and certainly represents the first comprehensive account of distinct cisco morphotypes within Great Bear Lake.

### Discussion Points

A participant asked about the diet analysis of ciscoes. The analysis examined the percentage of different prey in the diets of shallow- and deep-water ciscoes; the participant noted that this approach raised the question of whether a few fish ate many of a given species or many fish ate a small amount. They recommended that the diet analysis provide the data for individual ciscoes to determine how many fish ate what prey.

The presenter noted an error in the paper where copepods instead of cladocerans had been identified as making up the majority of the deep water cisco diet. A participant asked if sampling was done in seasons other than summer to determine what changes to the diet occurred during the year. The presenter responded that sampling was only done in the summer.

A conversation arose around the question of sampling at different water depths. A participant was uncomfortable with classifying shallow- and deep-water ciscoes by the depth of the water in which they were found. The presenter confirmed that she was able to identify the two types by sight, but added that identifying different morphs within those types was more challenging, and that limited time in the field made it difficult to work hands-on with the fish. New monitoring and sampling methods were being implemented, however, that would help with increasing and refining the data collected.

There was considerable discussion around the standardizing of data analyses. A participant suggested that creating guidelines outlining standardized research approaches for studies might be helpful for future analyses. It was also suggested that a common template be created for organizing data.

### Genetics

Working paper: Genetic differentiation and origin of the Shortjaw Cisco (*Coregonus zenithicus*) in the Great Lakes and other inland Canadian lakes

Authors: J. Turgeon, and A. Bourret

Presenter: Julie Turgeon

### Abstract

Ciscoes display a phenomenal level of ecophenotypic diversity throughout their North American range, leading to taxonomic uncertainty and complicating conservation efforts. Predictions associated with three hypotheses on the origin of this diversity, and in particular of the Shortjaw distinct phenotype, are evaluated. These hypotheses are the 'Plasticity Hypothesis', the 'Good Species Hypothesis', and the 'Parallel Origin Hypothesis'. Patterns of genetic variation at 290 AFLP loci among 1371 individuals from twenty lakes are analysed, including 387 individual fish identified as (or likely representing) Shortjaw Cisco (*Coregonus zenithicus*) from 10 lakes.

Genetic cluster analyses, association between individual genetic characteristics and phenotypic attributes, genetic re-allocation and analyses of molecular variance were performed. Evidence for the genetic distinctiveness of the Shortjaw Cisco was strong in Lake Nipigon, Trout Lake, Athapapuskow Lake and Great Bear Lake, weak in White Partridge Lake and Lake Superior, and absent in Brule Lake, Lake of the Woods, and Great Slave Lake. It could not be tested in Lake Huron. The Plasticity Hypothesis is dismissed given genetic distinctiveness of morphotypes within many lakes. There is no evidence that Shortjaw Cisco form a distinct

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lineage, contrary to the predictions of the Good Species Hypothesis. Shortjaw Cisco were always more closely related to sympatric forms than to Shortjaw Cisco from allopatric locations, in accordance with the Parallel Origin Hypothesis. From a genetic and evolutionary standpoint, the Shortjaw Cisco has multiple origins and is diagnosable only at the local scale.

### **Discussion points**

The presentation prompted considerable discussion around how to most effectively assess ciscoes as a species. The participants concluded that specific flocks should be assessed rather than the Shortjaw morphotype because historic taxonomic systems do not appropriately describe the evolutionary history of this group of species. One person added that cisco flocks are still undergoing speciation; the genetic structure therefore may be fragile to anthropogenic effects. Because the different types in the flock are dependent on each other for their existence, the participants agreed that an entire flock of ciscoes should be grouped together at the ecosystem level.

### **Taxonomic validity and Designatable Units**

All participants

The participants reviewed the seven terms of reference and decided that taxonomic and designatable unit structure needed to be emphasized during the remainder of the meeting, with threats as a second topic of discussion.

The group created notes on Shortjaw Cisco taxonomic validity and designatable units for the Science Advisory Report. These notes explained the insufficiencies of the existing taxonomy and stated that a new approach to delineating taxa within ciscoes and designatable units was required. The participants suggested a species-flock approach for the evaluation of ciscoes.

It was decided that wherever more than a single form of cisco occurs in a location, it would be considered a DU. Situations where divergent or unusual ciscoes occur (even when only one form was present) would need to be carefully evaluated to ensure that key diversity was assessed.

A participant proposed that the table of taxonomic designations and categories from the presentation on Shortjaw Cisco populations in inland Ontario lakes be included in the Science Advisory Report to give those species that have taxonomic validity the weight of research-based evidence. The other participants agreed.

The question was raised as to whether or not the COSEWIC assessment and update status report that was originally requested would still be written. The COSEWIC author responded that they would take the proposed structural revisions to the COSEWIC co-chairs and the subcommittee and let them determine what approach they would take for ciscoes.

### **Terms of Reference review and next steps**

Presenter: Chantelle Sawatzky

The terms of reference were reviewed. A detailed analysis of threats was not conducted at this meeting because several of the lake specialists with this expertise were not available for the discussion.

The following next steps were outlined:

Other cisco taxa may need to be included in the species' description, identification, and distribution.

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Information on *C. nigripinnis* and *C. nipigon* should be added to the Science Advisory Report. Evidence needs to be added for the delineation of the grouping for new world ciscoes and the explicit exclusion of old world ciscoes.

*C. laurettae* may only exist in Porcupine Lake, Yukon Territory.

The distribution map needs to be modified to include Great Bear Lake.

With these points the meeting concluded. The information presented during the meeting would be provided to the COSEWIC author following the completion of the final revisions.

## REFERENCES

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- Pratt, T.C. 2012. The distribution and abundance of deepwater ciscoes in Canadian waters of Lake Superior. *Advanc. Limnol.* 63: 25-41.
- Pratt, T.C., and Chong, S.C. 2012. Contemporary life history characteristics of Lake Superior deepwater ciscoes. *Aquat. Ecosyst. Health Manag.* 15: 322-332.

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## APPENDIX 1. TERMS OF REFERENCE

### Pre-COSEWIC Assessment for Shortjaw Cisco

### Regional Peer Review Meeting – Central & Arctic Region

October 30-31, 2012

Burlington, ON

Co-Chairpersons: Chantelle Sawatzky and Jim Reist

### CONTEXT

The implementation of the federal *Species at Risk Act* (SARA), proclaimed in June 2003, begins with an assessment of a species' risk of extinction by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). COSEWIC is a non-government scientific advisory body that has been established under Section 14(1) of SARA to perform species assessments, which provide the scientific foundation for listing species under SARA. Therefore, an assessment initiates the regulatory process whereby the competent Minister must decide whether to accept COSEWIC's assessment and add a species to Schedule 1 of SARA, which would result in legal protection for the species under the Act. If the species is already on Schedule 1 of SARA, the Minister may decide to keep the species on the list, reclassify it as per the COSEWIC assessment, or to remove it from the list (Section 27 of SARA).

Fisheries and Oceans Canada (DFO), as a generator and archivist of information on marine species and some freshwater species, is to provide COSEWIC with the best information available to ensure that an accurate assessment of the status of a species can be undertaken.

The Shortjaw Cisco (*Coregonus zenithicus*) was listed on COSEWIC's Fall 2011 Call for Bids to produce a status report.

### OBJECTIVES

The overall objective of this meeting is to peer-review DFO existing information relevant to the COSEWIC status assessment for Shortjaw Cisco in Canadian waters, considering data related to the status and trends of, and threats to this species inside and outside of Canadian waters, and the strengths and limitations of the information. This information will be available to COSEWIC, the authors of the species status report, and the co-chairs of the applicable COSEWIC Species Specialist Subcommittee. Publications from the peer-review meeting (see below) will be posted on the CSAS website.

Specifically, DFO information relevant to the following will be reviewed to the extent possible:

#### 1) Life history characteristics

- Growth parameters: age and/or length at maturity, maximum age and/or length
- Total and natural mortality rates and recruitment rates (if data are available)
- Fecundity
- Generation time
- Early life history patterns
- Specialised niche or habitat requirements

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## 2) Review of designatable units

Available information on population differentiation, which could support a COSEWIC decision of which populations below the species' level would be suitable for assessment and designation, will be reviewed. Information on morphology, meristics, genetics and distribution will be considered and discussed.

See COSEWIC 2008 "Guidelines for recognizing Designatable Units below the Species Level".

**3) Review the COSEWIC criteria** for the species in Canada as a whole, and for each designatable units identified (if any).

### COSEWIC Criterion – Declining Total Population

- a. Summarize overall trends in population size (both number of mature individuals and total numbers in the population) over as long a period as possible and in particular for the past three generations (taken as mean age of parents). Additionally, present data on a scale appropriate to the data to clarify the rate of decline.
- b. Identify threats to abundance— where declines have occurred over the past three generations, summarize the degree to which the causes of the declines are understood, and the evidence that the declines are a result of natural variability, habitat loss, fishing, or other human activity.
- c. Where declines have occurred over the past three generations, summarize the evidence that the declines have ceased, are reversible, and the likely time scales for reversibility.

**COSEWIC Criterion – Small Distribution and Decline or Fluctuation:** for the species in Canada as a whole, and for designatable units identified, using information in the most recent assessments:

- a. Summarise the current extent of occurrence (in km<sup>2</sup>) in Canadian waters
- b. Summarise the current area of occupancy (in km<sup>2</sup>) in Canadian waters
- c. Summarise changes in extent of occurrence and area of occupancy over as long a time as possible, and in particular, over the past three generations.
- d. Summarise any evidence that there have been changes in the degree of fragmentation of the overall population, or a reduction in the number of meta-population units.
- e. Summarise the proportion of the population that resides in Canadian waters, migration patterns (if any), and known breeding areas.

**COSEWIC Criterion – Small Total Population Size and Decline and Very Small and Restricted:** for the species in Canada as a whole, and for designatable units identified, using information in the most recent assessments:

- a. Tabulate the best scientific estimates of the number of mature individuals;
- b. If there are likely to be fewer than 10,000 mature individuals, summarize trends in numbers of mature individuals over the past 10 years or three generations, and, to the extent possible, causes for the trends.

Summarise the options for combining indicators to provide an assessment of status, and the caveats and uncertainties associated with each option.

For transboundary stocks, summarise the status of the population(s) outside of Canadian waters. State whether rescue from outside populations is likely.

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**4) Describe the characteristics or elements of the species habitat to the extent possible, and threats to that habitat**

Habitat is defined as "in respect of aquatic species, spawning grounds and nursery, rearing, food supply, migration and any other areas on which aquatic species depend directly or indirectly in order to carry out their life processes, or areas where aquatic species formerly occurred and have the potential to be reintroduced".

The phrasing of the following guidelines would be adapted to each specific species and some could be dropped on a case-by-case basis if considered *biologically* irrelevant. However, these questions should be posed even in cases when relatively little information is expected to be available, to ensure that every effort is made to consolidate whatever knowledge and information does exist on an aquatic species' habitat requirements, and made available to COSEWIC.

- a) Describe the functional properties that a species' aquatic habitat must have to allow successful completion of all life history stages.

In the best cases, the functional properties will include both features of the habitat occupied by the species and the mechanisms by which those habitat features play a role in the survivorship or fecundity of the species. However, in many cases the functional properties cannot be described beyond reporting patterns of distribution observed (or expected) in data sources, and general types of habitat feature known to be present in the area(s) of occurrence and suspected to have functional properties. Information will rarely be equally available for all life history stages of an aquatic species, and even distributional information may be missing for some stages. Science advice needs to be carefully worded in this regard to clearly communicate uncertainties and knowledge gaps.

- b) Provide information on the spatial extent of the areas that are likely to have functional properties.

Where geo-referenced data on habitat features are readily available, these data could be used to map and roughly quantify the locations and extent of the species' habitat. Generally however, it should be sufficient to provide narrative information on what is known of the extent of occurrence of the types of habitats identified. Many information sources, including Aboriginal Traditional Knowledge (ATK) and experiential knowledge, may contribute to these efforts.

- c) Identify the activities most likely to threaten the functional properties, and provide information on the extent and consequences of those activities.

COSEWIC's operational guidelines require consideration of both the imminence of each identified threat, and the strength of evidence that the threat actually does cause harm to the species or its habitat. The information and advice from the Pre-COSEWIC review should provide whatever information is available on both of those points. In addition, the information and advice should include at least a narrative discussion of the magnitude of impact caused by each identified threat when it does occur.

- d) Recommend research or analysis activities that are necessary.  
Usually the work on the other Guidelines will identify many knowledge gaps. Recommendations made and enacted at this stage in the overall process could result in much more information being available should a Recovery Potential Assessment be required for the species.

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## **5) Describe to the extent possible whether the species has a residence as defined by SARA**

SARA s. 2(1) defines Residence as "a dwelling-place, such as a den, nest or other similar area or place, that is occupied or habitually occupied by one or more individuals during all or part of their life cycles, including breeding, rearing, staging, wintering, feeding or hibernating."

## **6) Threats**

A threat is any activity or process (both natural and anthropogenic) that has caused, is causing, or may cause harm, death, or behavioural changes to a species at risk or the destruction, degradation, and/or impairment of its habitat to the extent that population-level effects occur. Guidance is provided in: Environment Canada, 2007. Draft Guidelines on Identifying and Mitigating Threats to Species at Risk. *Species at Risk Act Implementation Guidance*.

List and describe threats to the species considering:

- Threats need to pose serious or irreversible damage to the species. It is important to determine the magnitude (severity), extent (spatial), frequency (temporal) and causal certainty of each threat.
- Naturally limiting factors, such as aging, disease and/or predation that limit the distribution and/or abundance of a species are not normally considered threats unless they are altered by human activity or may pose a threat to a critically small or isolated population.
- Distinction should be made between general threats (e.g. agriculture) and specific threats (e.g. siltation from tile drains), which are caused by general activities.
- The causal certainty of each threat must be assessed and explicitly stated as threats identified may be based on hypothesis testing (lab or field), observation, expert opinion or speculation.

## **7) Other**

Finally, as time allows, review status and trends in other indicators that would be relevant to evaluating the risk of extinction of the species. This includes the likelihood of imminent or continuing decline in the abundance or distribution of the species, or that would otherwise be of value in preparation of COSEWIC Status Reports.

## **Working Paper(s)**

Any working papers related to the status of Shortjaw Cisco being reviewed at the meeting will be made available to all participants by 16 October 2012.

## **Expected Publications**

- Proceedings
- Research Documents

## **Participation**

Participation is expected from:

- Relevant DFO Sectors
- COSEWIC status report author
- Members of COSEWIC (Co-Chairs and/or SSC experts)

Participation may also include:

- Academia
- Other invited external experts as deemed necessary

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## APPENDIX 2. MEETING PARTICIPANTS

Participant	Affiliation
Dave Boguski	Fisheries and Oceans Canada, Science
Lynn Bouvier	Fisheries and Oceans Canada, Science
Dana Boyter	Fisheries and Oceans Canada, Species at Risk
Kim Howland	Fisheries and Oceans Canada, Science
Riley Magee	Rapporteur
Nick Mandrak	Fisheries and Oceans Canada, Science
Andrew Muir	Great Lakes Fishery Commission
Tom Pratt	Fisheries and Oceans Canada, Science
Scott Reid	Ontario Ministry of Natural Resources
Jim Reist (co-chair)	Fisheries and Oceans Canada, Science
Chantelle Sawatzky (co-chair)	Fisheries and Oceans Canada, Science
Julie Turgeon	Université Laval

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### APPENDIX 3. AGENDA

#### Pre-COSEWIC Assessment – Shortjaw Cisco

#### Regional Advisory Meeting – Central and Arctic Region

Location: Library Guest Lounge, Canadian Centre for Inland Waters

Burlington, ON

Date: 30-31 October 2012

Chairs: Chantelle Sawatzky and Jim Reist

#### Day 1: 9am – 5pm

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Welcome and Introductions	Jim Reist	9:00
Purpose of Meeting – Introductory Presentation	Chantelle Sawatzky	9:15
COSEWIC Perspective on Designatable Units	Nick Mandrak	9:30
An overview of Shortjaw Cisco Populations in Inland Ontario Lakes	Scott Reid	9:45
Health Break	15 minutes	10:15
Working Paper No. 1: Patterns of Morphological Diversity in Ciscoes Distributed Within Three of Manitoba's Glacial Relict Lakes, With Reference to <i>Coregonus zenithicus</i> in Lake Superior, Ontario	Dave Boguski	10:30
Working Paper No. 2: Ciscoes of Lake Superior and Lake Nipigon	Tom Pratt	11:00
Lunch	1 hour	11:45 - 12:45
Working Paper No. 3: Ciscoes ( <i>Coregonus</i> spp.) of Lake Huron, 2002-2005	Nick Mandrak	12:45
Working Paper No. 4: Morphology and Ecology of Cisco (Salmoniformes: Coregonidae) in Great Slave Lake: Identification by Body Shape, Meristic Characters, Age and Growth, Trophic Ecology and Habitat Use	Andrew Muir	1:45
Health Break	15 minutes	2:45
Working Paper No. 5: Cisco Diversity in Great Bear Lake, NT (including diet analyses)	Kim Howland	3:00
Day 1 Wrap-up	Jim Reist	4:30

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**Day 2: 9am – 5pm**

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Working Paper No. 6: Great Lakes and Inland Canadian Lakes Cisco Genetics (interim report)	Julie Turgeon	9:00
Health Break	15 minutes	10:30
Group Discussion – Science Advice regarding taxonomic validity and designatable units	All	10:45
Lunch	1 hour	11:45-12:45
Group Discussion and drafting of Science Advisory Report (SAR)	All	12:45
Health Break	15 minutes	2:15
Groups Discussion and drafting of SAR continued if necessary	All	2:30
Review Terms of Reference & Next Steps	Chantelle Sawatzky	4:00

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